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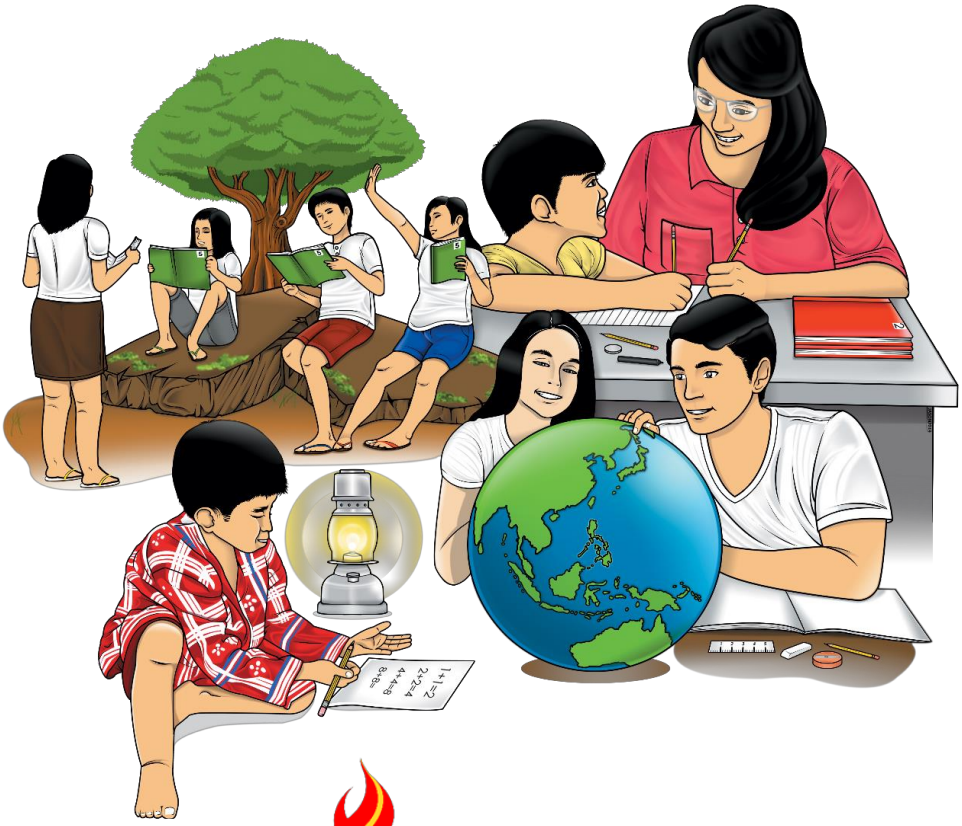
Science

Quarter 4 – Module 1.2: Charles' Law



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Quarter 4 – Module 1.2: Charles' Law
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Science

Quarter 4 – Module 1.2:
Charles' Law

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

How can you relate volume and temperature in real life situation? Charles's law is responsible for the inflated tubes protruding out from a tire when it is left stranded in the hot summer days. The severe heat outside steadily flows into the tube and gradually causes the tire to expand. During cold days wherein the temperature in the environment is lower, the tire gets deflated.

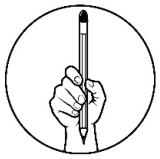
This module will provide you with information and simple activities that will help you understand volume and temperature relationships at constant pressure of gases.

After going through this module, you are expected to:

1. investigate the relationship between volume and temperature at constant pressure of a gas **(S10MT-IVa-b-21*)***;
2. solve problems involving changes in the condition of the gas using the equation for Charles' Law; and
3. give application of Charles' Law in real life situations.

Going through this module can be a meaningful learning experience. All you need to do is make use of your time and resources efficiently. To do this, here are some tips for you:

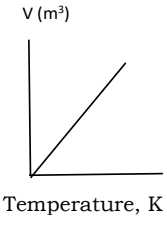
1. Take the pretest before reading the rest of the module.
2. Take time in reading and understanding the lesson. Follow instructions carefully. Do all activities diligently. This module is designed for independent or self-paced study. It is better to be slow but sure than to hurry and miss the concepts you are supposed to learn.
3. Use a clean sheet of paper for your answers in each activity or assessment. Do not forget to write your name. Label it properly.
4. In problem solving, write first the given data as well as the required variable. Then identify the equation to be used.
5. Numerical answers should be in proper significant figures. In gas laws, use the smallest number of significant figures given in the problem.
6. Be honest. When doing the activities, record only what you have really observed. Take the self-assessments after each activity, but do not turn to the Answer Key page unless you are done with the entire module.
7. Don't hesitate to ask. If you need to clarify something, approach or contact your teacher or any knowledgeable person available to help you. You may also look into other references for further information. There is a list of references at the back part of this module.
8. Take the posttest prepared at the end of the module for you to assess how much you have learned from this module.
9. You can check your answers in the activities, self-assessments, and posttest after you have finished the entire module to know how much you have gained from the lesson and the activities.



What I Know

Directions: Answer the following questions to the best of your ability. The objective of this part is to gauge your prior knowledge on the relationship of volume and pressure at constant temperature. Use a separate sheet of paper for your answers.

1. Who was the French scientist who made accurate observations on how the volume of the gas is related to temperature?
   a. Amedeo Avogadro
   b. Gay-Lussac
   c. Jacques Charles
   d. Robert Boyle
2. Which of the following is constant when using the Charles' Law?
   a. energy
   b. pressure
   c. temperature
   d. volume
3. When temperature of a gas goes down, what happens to its volume?
   a. goes down
   b. goes down then rises
   c. rises
   d. rises then falls
4. Which of the following graph correctly represents the relationship between volume and temperature of an ideal gas that is held at constant pressure?

   a.
   

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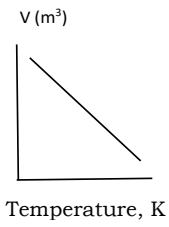
   

   c.

   d.

5. Which of the following quantities are directly proportional in Charles' Law?
   a. number of moles and volume
   b. pressure and temperature
   c. volume and pressure
   d. volume and temperature
6. What is the value of "k" in Charles' Law?
   a. $\frac{V}{n}$
   b. $\frac{V}{P}$
   c. $\frac{V}{T}$
   d. $\frac{V}{V}$
7. What temperature scale must be used when applying Charles' law?
   a. Celsius
   b. Fahrenheit
   c. Kelvin
   d. Both a & b
8. How will you convert Celsius temperature to Kevin?
   a. add 273.15 to Celsius temperature
   b. divide Celsius temperature by 273.15
   c. multiply Celsius temperature and 273.15
   d. subtract 273.15 from Celsius temperature
9. What is the equivalent value of 35ºC in Kelvin?
   a. 7.8043 K
   b. 238.15 K
   c. 308.15 K
   d. 9,560 K

For items 10 & 11, refer to the data presented in the table below:

Volume-Temperature Data of a Gas Obtained at Constant Pressure

T (^{0}C)	V (cm^3)
0	20.0
50	24.0
80	26.4
100	28.0
150	32.0
250	40.0

10. What relationship between volume (V) and temperature (t) of a confined air can be drawn from the data?
    a. The volume is directly proportional to temperature.
    b. The volume is inversely proportional to its temperature.
    c. The volume is directly proportional to the square of its temperature.
    d. Temperature and volume have no relationship since both are independent variables.
11. What is the temperature of the confined gas in degree Kelvin when its volume is 32 cm^3?
    a. 150 b. 220 c. 273 d. 423
12. Which of the following illustrates the mathematical statement of Charles' Law?
    a. $P_1V_1 = P_2V_2$
    b. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
    c. $P_1T_1 = P_2T_2$
    d. $\frac{V_1P_1}{T_1} = \frac{V_2P_2}{T_2}$
13. A balloon with a volume of 250 mL at 25°C is submerged in hot water to obtain a temperature of 50°C. Find out what will happen to the volume of the balloon, provided the pressure remains the same.
    a. The volume of the balloon will become higher than 250 mL.
    b. The volume of the balloon will become lower than 250 mL.
    c. The volume of the balloon will stay the same.
    d. There is no enough data.
14. A 420 mL of a sample of gas at 25.0°C is compressed to 210 mL. What is the temperature of the gas after compression? The pressure remains constant.
    a. 12.5 K b. 50.0 K c. 149 K d. 626 K
15. A sample of helium gas is heated from 15.0°C to 30.0°C. This heating process causes the gas to expand to a volume of 585 cm^3. What was the original volume of the helium gas?
    a. 149 cm^3 b. 293 cm^3 c. 556 cm^3 d. 615 cm^3

Answer Key on page 15

How did you find the pretest? What was your score? If you got 15 items correctly, you may skip the module. But if your score is 14 and below, you must proceed with the module.

Lesson 1 Charles' Law

What's In

Suppose the pressure on a certain amount of gas is kept constant. How will the change in temperature affect its volume?

Directions: Throughout this module we will be dealing with volume and temperature. Let us recall their symbols as well as their common units by completing the table.

Property	Symbol	Common Units
Temperature		
Absolute Temperature		
Volume		

Give the absolute temperature of the following using the

Formula: K = °C + 273.15

1. 0 ° C
2. 100 ° C
3. 173 ° C
4. -150 ° C

Give the equivalent Celsius temperature of the following absolute temperature:

Formula: °C = K – 273.15

5. 100 K
6. 325.85 K
7. 313 K

In the first module, Boyle's Law depends on the temperature of the system remaining constant. But, suppose the temperature changes, how does a change in temperature affect the volume of a gas? Let us find out in the next activity.

What's New

Magic in Balloon

What you need:

small deflated toy balloon
bowl of extremely hot water
bowl with ice
vial or small bottle
rubber band

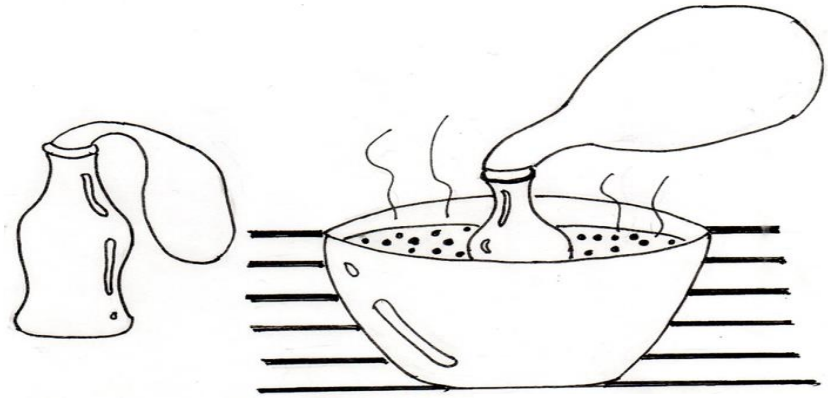
What you have to do:

1. Place the open end of the toy balloon around the neck of the bottle. If it does not fit tightly, secure it with a rubber band.
2. Put the bottle with attached toy balloon in the bowl of extremely hot water. After a few minutes, observe what happens. **Note: Wear gloves or use a pot holder when handling hot bottle.**
   - What happened to the toy balloon when it was immersed in hot water?

     _____
3. Remove the bottle from the hot water and place it in the bowl with ice.
   - What happened to the toy balloon when it was immersed in cold water?

     _____
4. Based on your observation, what is the relationship of temperature and volume of a fixed amount of gas?

   _____



Illustrator: Anjo C. Layoso,
SDO San Carlos City, Pangasinan

Figure 1. Demonstrating Charles' Law using a toy balloon

What is It

Most of you might have observed the following phenomena which are all real-life examples of Charles' Law:

- after you inflate a pool float and push it into the pool, it seems a bit under-inflated;
- a basketball when left outside on a cold night shrinks in size;
- warning signs on a bottle of deodorant indicating the bottle to be kept away from the sunlight and high temperature; and
- working of the hot air balloon.

In 1787, the French inventor Jacques Charles, while investigating the inflation of his manned hydrogen balloon, discovered that the volume of a gas varied directly with temperature. Charles's Law states that the volume of a given mass of gas varies directly with the absolute temperature of the gas when pressure is kept constant. The temperatures are conventionally measured in Kelvin, the SI unit of temperature.

Since the volume of a gas decreases with falling temperature, scientists realized that a natural zero-point for temperature could be defined as the temperature at which the volume of a gas theoretically becomes zero.

Jacques Charles

Illustrator: Anjo C. Layoso, SDO San Carlos City, Pangasinan

The absolute temperature scale was devised by the English physicist Kelvin, so temperatures on this scale are called *Kelvin* (*K*) temperatures. The Kelvin scale must be used because zero on the Kelvin scale corresponds to a complete stoppage of molecular motion.

What's More

The relationship between temperature and volume was proven in the earlier activity. Here are some enrichment activities for you to work on to intensify the concept of Charles' Law.

Activity 1. Charles' Law Displayed Graphically

What you need:

- ✓ separate sheet of paper
- ✓ pencil
- ✓ ball pen

What you have to do:

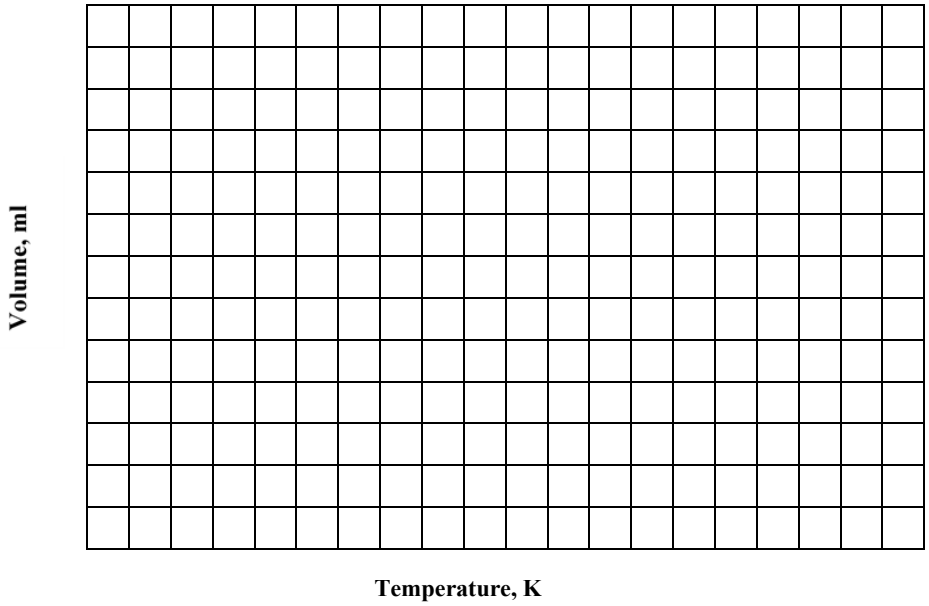
1. Get a separate sheet of paper for your answers and observation.
2. The table below shows temperature in kelvin (K) and volume (mL) data for a set amount of gas at a constant pressure. Compute $\frac{V}{T}$ which is the constant k in the third column.

Temperature (K)	Volume (mL)	$\frac{V}{T} = k$ $(\frac{mL}{K})$
50	22.5	
100	45.0	
150	67.5	
200	90.0	
300	135.0	
500	225.0	
800	360.0	
1000	450.0	

3. Refer to Column 3, what can you conclude as to the values of "k"?

   _____

4. Plot the temperature (K) on the x-axis against the volume (mL) on the y-axis.

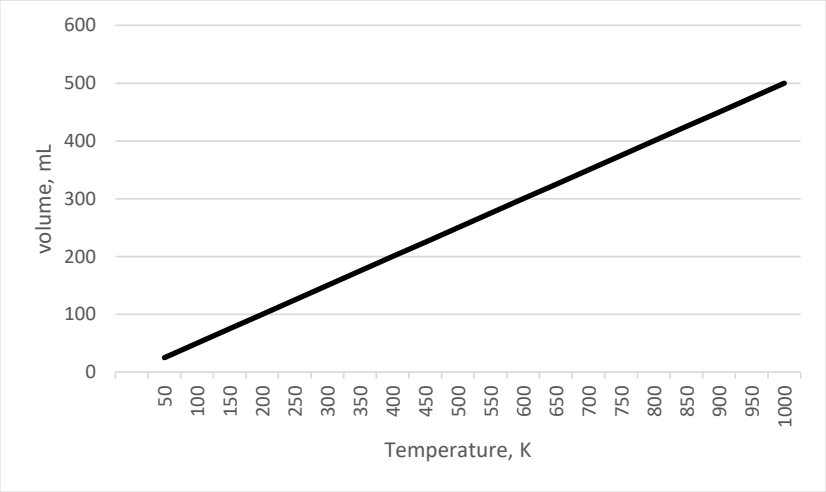


5. What does the graph show about the relation between volume and temperature of a gas at constant pressure? _____
_____

6. What is the temperature when the volume is equal to zero? Hypothetically speaking, what does this indicate? _____
_____

Assessment 1

Directions: Use the graph below Volume vs Temperature to answer the following questions. Use a separate sheet of paper for your answers.



1. As the temperature of the gas increases from 300 K to 500 K, does the volume of the gas increase or decrease? _____
2. What is the volume of this gas sample when its temperature is 700 K? _____
3. What is the temperature of the gas when it occupies a volume of 350 mL? _____
4. What is the temperature of the gas when its volume is 0? _____
5. Compute for the value of "k". _____

Activity 2. Figure Me Out Numerically

Charles' law states that for a fixed amount of an ideal gas its volume is directly proportional to its temperature at constant pressure. Mathematically, the direct relationship of Charles's Law can be represented by the equation:

$$V \propto T \quad \text{at constant pressure}$$

To remove the proportionality h sign, a constant, k, is introduced.

$$V = kT$$

Then

$$k = \frac{V}{T}$$

If the same gas is brought to different temperatures, it will give two different volumes. The equation will become

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

where:

T_1 = initial temperature of the gas **T_2** = final temperature of the gas

V_1 = initial volume of the gas **V_2** = final volume of the gas

Any unit of volume may be used, provided that the unit of V_1 and V_2 are the same. However, only Kelvin scale may be used for the temperature. The absolute temperature is temperature measured with the Kelvin scale.

What you need:

- ✓ separate sheet of paper
- ✓ ball pen
- ✓ calculator

What you have to do:

1. Get a separate sheet of paper for your answers.
2. Using the Charles' Law formula, derive the formula of the following:
   a. V_1
   b. V_2
   c. T_1
   d. T_2

3. Solve the following problems.
   a. A balloon is filled to a volume of 2.20 L at a temperature of 25.0 °C. The balloon is then heated to a temperature of 51.0 °C. Find the new volume of the balloon.

      Given: V_1 = _____ T_1 = _____

      T_2 = _____

      Required: _____

      Solution:

      $$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

      Answer: _____

   b. A gas has an initial volume of 3,480 mL and an initial temperature of −70.0°C. What must be the temperature of the gas in Kelvin if its volume is reduced to 2,450 mL?

Given:
Required:
Solution:
Answer:

Assessment 2

Directions: Answer the following questions to the best of your ability. Use a separate sheet of paper for your answers.

1. Which quantity remains constant in defining Charles's law?
   a. Force
   b. Pressure
   c. Temperature
   d. Volume
2. What is the mathematical expression of Charles' Law?
   a. $k = \frac{V}{n}$ b. $k = \frac{V}{V}$ c. $k = \frac{V}{P}$ d. $k = \frac{V}{T}$
3. Assuming that the pressure and amount of gas remain constant, which of the following is the correct formula of Charles's Law?
   a. $\frac{V_1}{V_2} = \frac{T_2}{T_1}$
   b. $V_1T_1 = V_2T_2$
   c. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
   d. $\frac{P_1}{V_1} = \frac{P_2}{V_2}$
4. The temperature of a gas in a 4.0-liter container is 300 K. What will be its volume if the temperature is increased to 600 K.? The pressure remains constant.
5. The volume of a gas decreased from 1.4 L to 1.2 L when the temperature was lowered. If the initial temperature was 6.0 ºC, what would be the final temperature in ºC, assuming that the pressure did not change?

Activity 3. Real Life Applications in Focus

What you need:

- ✓ separate sheet of paper
- ✓ ball pen

What you have to do:

Get a separate sheet of paper and answer the following questions.

1. We all have seen hot air balloons flying. But has anyone wondered how it works? An air balloon consists of a bag, a basket to carry passengers, and a source of heat. The heat source is usually a fuel like propane which on burning causes the heating of the air surrounding it. How is Charles' Law applied in hot air balloons?

Answer:

2. If you get a chance to read the instructions on a bottle of deodorant, you might have read the warning signs indicating the bottle to be kept away from the sunlight and high temperature. How is Charles' Law applied in this situation?

Answer:

3. Yeast is used in preparation of many bakery products. This yeast keeps liberating carbon dioxide gas. How is Charles' Law applied in baking?

Answer:

Assessment 3.

Directions: Read carefully each item. Write "Yes" if the item is an application of Charles' Law and "No" if it is not. Use a separate sheet for your answers.

1. Jogging is very difficult in during the month of December compare to the month of April. The reason is simply due to low temperatures our lungs shrink which decrease the human lungs' capacity.
2. A pressure cooker reducing the cooking time of food.
3. When ascending or descending in a plane, or taking a subway or train under a deep waterway, your ears "pop," or feel uncomfortable.
4. When bloated pool floats are pushed into pools, they appear as under-inflated.
5. Turkey thermometer is placed in the turkey. As the temperature increases and the turkey cooks, the air in the thermometer expands to pop the plunger.

What I Have Learned

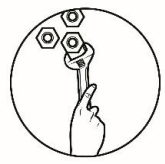
Great job! You are almost done with this module. Let's summarize what you have learned from the lesson and activities by choosing the correct word inside the parentheses. Use a separate sheet of paper and write only your answer.

1-5. A French physicist, 1. (Robert Boyle, Jacques Charles) in 1787 proposed the relationship between 2. (volume and pressure, volume and temperature). He concluded that when the 3. (pressure, temperature) is kept constant, its volume is 4. (directly, inversely) proportional to the 5. (pressure, temperature)

6-9. Charles' Law means that the volume of a gas increases as the 6. (pressure, temperature) 7. (drops, rises) and the volume decreases as 9. (pressure, temperature) (drops, rises).

10-12. The absolute temperature is measured with the 10. (Celsius, Kelvin) scale. The 11. (Celsius, Kelvin) scale must be used because zero on the 12. (Celsius, Kelvin) scale corresponds to a complete stoppage of molecular motion.

13-15. According to 13. (Boyle's Law, Charles's Law), if a balloon is filled with a heated gas, its volume must 14. (contract, expand). At an elevated temperature the balloon then occupies a larger volume in the same weight as the surrounding air — its density is now 15. (less, more) than the cold air and consequently, the balloon begins to rise.



What I Can Do

Let's bring Charles' Law in action by giving solution to the following problems:

1. **Pump up your ping pong ball**.
   If you play ping pong, possibilities are you've come across the occasionally dented ball. How will you restore its roundness?
2. **Baking**
   We can see Charles's law in our kitchens also. Using a yeast as an ingredient, how is the law applied in delicious bakery products like bread, and cakes?
3. **Deodorant Spray Bottle**
   Have you read the cautions written in the deodorant bottle? They suggest storing it below 50°C and also warn to keep it away from direct sun light and ignition. How can you explain this using Charles' law?

Rubric:

5 points - The student demonstrates a thorough understanding of the concept behind the task. The response may contain minor flaws that do not weaken from the demonstration of a thorough understanding.

4 points - The student demonstrates an understanding of the of the concept behind the task. The response essentially corrects and demonstrates an essential but less than thorough understanding of the science.

3 points - The student demonstrates only a partial understanding of the concept behind the task. Although the student may have used the correct approach to a solution or may have provided a correct solution, the work lacks an essential understanding of the underlying science concepts.

2 points - The student demonstrates a very limited understanding of the concept behind the task. The response is incomplete and exhibits many flaws.

1 point - The student provides a completely incorrect solution.

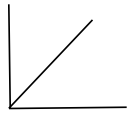
0 point - No response at all.

Assessment

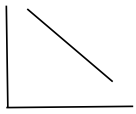
Directions: Read carefully each item. Use a separate sheet for your answers. Write only the letter of the correct answer for each question.

1. Which of the following scientists pioneered the experimentation of volume and temperature relationships at constant pressure?
   a. Amedeo Avogadro
   b. Gay-Lussac
   c. Jacques Charles
   d. Robert Boyle
2. Which statement describes the volume-temperature relationship in gases at constant pressure?
   a. As temperature decreases, volume increases.
   b. As temperature increases, volume also increases.
   c. As temperature increases, volume remains constant.
   d. As temperature remains constant, volume increases.
3. Which of the following quantities are directly proportional in Charles' Law?
   a. number of moles and volume
   b. pressure and temperature
   c. volume and pressure
   d. volume and temperature
4. Which of the following needs to remain constant when using the Charles' Law?
   a. mass and pressure
   b. mass and temperature
   c. volume and pressure
   d. volume and temperature
5. Which graph correctly represents Charles' Law?

a. V, m^3 Temperature, K

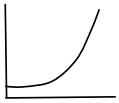


b. V, m^3 Temperature, K



c. V, m^3 Temperature, K

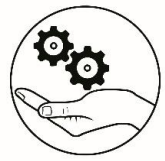
d. V, m^3 Temperature, K



6. What happens to a gas at 0 K?
   a. The molecules disappear.
   b. The molecules divide.
   c. The molecules stick to each other.
   d. The molecules stop moving.
7. Which of the following involved the application of Charles' Law?
   a. bicycle pump
   b. scuba diving
   c. soda cans/bottles
   d. syringes
8. If the volume of a container of gas is reduced, what will happen to the temperature inside the container?
   a. The temperature will decrease.
   b. The temperature will increase.
   c. The temperature will fluctuate.
   d. The temperature will not change.
9. In order for the relationship between temperature and volume described by Charles' Law to work, what must be the unit of temperature?
   a. Celsius (°C)
   b. b. Fahrenheit (°F)
   c. Kelvin (K)
   d. Pascal (Pa)
10. What is the equivalent value of 25ºC in Kelvin?
    a. 11 K b. 248.15 K c. 298.15 K d. 6,829 K

11. What happens to the volume of a gas when it is compressed?
    a. The volume becomes unpredictable.
    b. The volume decreases.
    c. The volume does not change.
    d. The volume increases.
12. To what Celsius temperature must 580 cm^3 of oxygen at 20.0 ^0C be raised to increase its volume to 750 cm^3?
    a. -46.0 ^0C b. 25 ^0C c. 106 ^0C d. 1211 ^0C
13. A gas evolved during the fermentation of glucose has a volume of 780 mL at 20.1 ºC and 1.00 atm. What was the volume of this gas at the fermentation temperature of 36.5 ºC. The pressure remained constant.
    a. 116 mL b. 430 mL c. 739 mL d. 824 mL
14. An aerosol can contains 452 mL of gas 22.0^0C. What is the final temperature if the volume is increased to 705 mL?
    a. -84.7 ºC b. 187 ^0C c. 307 ºC d. 807 ºC
15. Which of the following **does not** involve the application of Charles' Law?
    a. baking b. bloated tire c. hot air balloon d. syringe

Congratulations for accomplishing this module! You may now look at the correct answers to all the activities and assessments. The Answer Key is found on page 16.



Additional Activity

Before you return this module to your teacher, kindly copy and fill out the Self-Rating table adapted from Valdoz (2017). Check the appropriate column where your extent of knowledge falls.

How I Rate My Self...

How much did this module help you...	**Poor (1)**	**Fair (2)**	**Good (3)**	**Excellent (4)**
define the relationship between volume and temperature at constant pressure?				
derive the formula of Charles' Law?				
solve problems involving Charles' Law?				
relate real life situations to Charles' Law?				

Answer Key

What I Know

1. c	6. c	11. d
2. b	7. c	12. b
3. a	8. a	13. a
4. a	9. c	14. c
5. d	10. a	15. c

What's In

Property	Symbol	Common Units
Temperature	T	^oC, ^oF
Absolute temperature	T	K
Volume	V	mL, L, cm^3, m^3

1. 273.15 K
2. 373.5 K
3. 446.15 K
4. 123.15K
5. -173.15^oC
6. 52.70 ^oC
7. 39.85 ^oC

What's New
Magic in Balloon

2. The balloon expands and rises.
3. The balloon shrinks.
4. An increase in temperature corresponds to an increase in volume and vice versa.

What's More
Activity 1. Figure Me Out Numerically

k = 0.45 (3rd Column in the table)

1.According to Charles' Law, if a balloon is filled with a heated gas, its volume must increase. At an elevated volume, the balloon then occupies a larger volume in the same weight as the surrounding air — its density is now less than the cold air and consequently, the balloon begins to rise.
2. The answer lies in Charles' Law. Under high temperatures, the air molecules inside the bottle will increase which can lead to the exploding of the deodorant bottle.
3.Yeast is used in preparation of many bakery products. This yeast keeps releasing carbon dioxide gas. These carbon dioxide bubbles expand further with high temperature. The expansion of the carbon dioxide bubbles with an increase in temperature works as a leavening agent and cause the bakery products to become fluffy.

Activity 3. Real Life Applications in Focus

1. b	2. d	3. C
4. 8.0 L	5. -34 ^oC	

Assessment 2

3.
a. Given: $V_1 = 2.20$ L
$T_1 = 25.0 + 273.15 = 298.15$ K
$T_2 = 51.0 + 273.15 = 324.15$ K
Required: V_2
Solution:
$V_2 = V_1T_2/T_1 = 2.20$ l (324.15 K) / 298.15 K
Answer: $V_2 = 2.39$ L

b. Given: $V_1 = 3{,}480$ mL
$V_2 = 2{,}450$ mL
$T_1 = -67 + 273.15 = 203.15$ K
Required: T_2 (K)
Solution:
$T_2 = V_2T_1/V_1 = 2450$ mL (203.15 K) / 3,480 mL
Answer: $T_2 = 143$ K

2.
a. $V_1 = V_2T_1/T_2$ c. $T_1 = V_1T_2/V_2$
b. $V_2 = V_1T_2/T_1$ d. $T_2 = V_2T_1/V_1$

Activity 2. Charles' Law Figure Out Numerically

1. increases	2. 350 mL	3. 700 K
4. 0 K	5. 0.50 mL/K	

Assessment 1

5. The volume of a fixed mass of gas at constant pressure is directly proportional to temperature.
6. The temperature at which the volume of gas equals is zero. All gases would have liquefied before this temperature is reached. This is only a hypothetical condition.

Assessment

1. c	4. a	7. c	10. c	13. d
2. b	5. a	8. a	11. b	14. b
3. d	6. d	9. c	12. c	15. d

Assessment 3.

1. Yes	2. No	3. No	4. Yes	5. Yes

What I Have Learned

1.	Jacques Charles	9. drops
2.	volume and temperature	10. Kelvin 11. Kelvin
3.	pressure	12. Kelvin
4.	directly	13. Charles' Law
5.	temperature	14. expand
6.	temperature	
7.	rises	15. less
8.	temperature	

What I Can Do

1. Let your ping pong ball float on warm water for some time, thus increasing the temperature of the air inside the ball. In turn, this will lead to an increase in the volume of the gas. Therefore, the shape of the ball is restored.
2. Bakery products like bread, and cakes would not be spongy and soft without yeast. Yeast produces carbon dioxide gas. When bread and cakes are baked at high temperatures; with an increase in temperature, carbon dioxide gas expands. As a result of this expansion, our bread and cakes become deliciously spongy and fluffy in appearance and ready to serve.
3. According to Charles law definition; under high temperatures, the gas molecules inside the deodorant bottle expands. Therefore, leads to the bursting of the deodorant bottle.

References

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https://drive.google.com/file/d/1WHQ1UVSkBIB5kbnblkOeHGTOQ1eB7Fk8/viewDepartment of Education. "*K to 12 Curriculum Guide Science (Grade 3 to 10).*" Accessed October 2019. "https://www.deped.gov.ph/wp-content/uploads/2019/01/Science-CG_with-tagged-sci-equipment_revised.pdf.

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